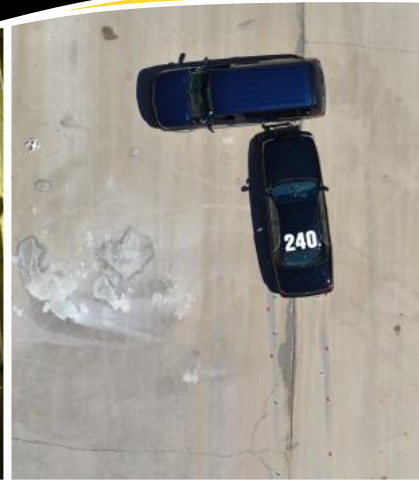


# Unmanned Aerial Vehicle (UAV) Capabilities



**Confined Space Inspection**



**Accident Reconstruction**



**Saginaw Bay, MI Wetland Analysis**

MTRI utilizes remote controlled helicopters to collect remote sensing data. With current advances in these technologies, they have become cheaper and more capable systems. In combination with similar advances in sensors, unmanned aerial vehicles (UAVs) are a more practical and cost effective way to collect remote sensing data.

UAVs can be equipped with a variety of sensors, including optical (visible and near-infrared light), thermal, and LiDAR. They also come in several main platforms, including single-rotor helicopters, multi-rotor helicopters, tethered devices (such as balloons and blimps), and fixed-wing aircraft. MTRI has focused on using multirotor based platforms due to their stability and the ability to takeoff and land vertically. This allows for the operation not only from land but also from small boats for aquatic studies.

UAVs can be used for a variety of research. This includes transportation infrastructure assessment, corridor monitoring, wetlands mapping, invasive species identification, and other applications. The advantage of using UAVs is that they are a low cost alternative to collecting aerial remote sensing where and when its needed. Unlike optical satellite collects, UAVs are not restricted to cloud cover or having to wait for an overpass.

With multiple platforms available MTRI is able to investigate a wide variety of sites ranging from confined space inspection to diverse terrestrial and aquatic collects. Projects have been funded through agencies such as USDOT and Michigan DOT to demonstration applications of UAVs. Data collection flights have been completed in Michigan, Alaska, Iowa, Nebraska, Texas, Maryland, and elsewhere.



**Unpaved Road Assessment**



**Bridge Condition Assessment**



**Les Cheneaux Islands Aquatic Plant Mapping**

The **Bergen Hexacopter** can fly for up to 30 minutes with a 5 kg payload. It has a global position system (GPS) inertial measurement unit (IMU) which allows for flying programmed way points that are assigned through Ground Station software that uses a Google Earth interface. With a stabilized gimbal that keeps the camera pointed down regardless of the motion of the hexacopter, this provides a more stable platform than the single rotor helicopter. The added first person viewer (FPV) allows the pilot to see the field of view of the camera as well as provide a read out of the altitude, speed and battery voltage. *Manufactured in Michigan.*



**Bergen Hexacopter**

The **Bergen "Quad-8" Octocopter** can fly up to 20 minutes and with up to a 8kg payload. The heavier lifting capacity is due to the additional number of propellers (eight as compared to six). The added number of propellers also aids in safety. Additionally, the Quad-8 has a GPS and IMU, allowing for programmable waypoint flights. FPV capabilities also allow the pilot to see the field of view, altitude, speed, and battery voltage in real-time. Both Bergen platforms have provided durable systems for completing high-resolution 3D mapping and thermal assessments. *Manufactured in Michigan.*



**Bergen Octocopter  
(Quad-8)**

The **DJI Mavic Pro** is a small, foldable, portable, and very stable UAV platform capable of flights up to 27 minutes and speeds of 40mph up to 4 miles away. The onboard optical sensor (on a 3-axis gimbal) has a image resolution of 12 megapixels and 4K video resolution. Additional sensors provide collision avoidance, enabling the Mavic Pro to not hit obstacles in front of it by stopping any forward movements towards the obstacle from 50 ft (15 m). The DJI GO 4 app provides the pilot with real-time vital information video.



**DJI Mavic Pro**

The **DJI Phantom 3 Advanced** comes equipped with a 12 MP camera capable of 2.7K video that also doubles as an FPV and can fly for up to 25 min. Equipped with a GPS IMU, the Phantom can hold its position while in flight and complete autonomous pre-programmed missions. The vehicle's unloaded weight is approximately 1 kilogram is small enough to be easily transported for diverse data collection needs.



**DJI Phantom 3  
Advanced**

**Micro UAVs** are the smallest quadcopters in MTRI's fleet. Currently MTRI is using a variety of models for testing in confined spaces, such as culverts and pump stations. Their capabilities range from being able to record HD video, transmit a live video stream and also demonstrate obstacle avoidance. MTRI's Blackout Mini H Quad is capable of indoor and outdoor flight with a camera and FPV system.



**Blackout Mini H Quad**

## Contact Information:

### Colin Brooks

Lab Manager

cnbrooks@mtu.edu

(734) 913-6858

### Richard Dobson

Research Scientist

rjdobson@mtu.edu

(734) 913-6872



**Michigan Tech**  
Research Institute

For more information, visit [www.mtri.org](http://www.mtri.org) and [www.mtri.org/unpaved](http://www.mtri.org/unpaved)